A 2nd proposal for a Low mass electron pair trigger.

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Trigger Working Group Meeting
??

New things from last time

- New assumptions for number of events
  - Assume we can take effectively 40 MB/sec with a 50% duty factor
  - Assume different division
    - 40% to MB ➔ 4x previous (useful for everyone)
    - 30% to electron arm trigger ➔ 1.5x previous
    - 30% to muon trigger ➔ 1.5x previous
  - Tony did a calculation which shows the enhancement using a straight centrality trigger to get central events is not much better than taking min-bias

Total yields – 4x more optimistic

- New Assumptions
  - 10 week run - 3M secs (this includes 50% duty factor)
  - Assuming 0.4 to min bias, equivalent band width = 40MB/sec
  - min bias event size 250 Kb
  - 40 MB/sec /250 KB/minbiasevent * 0.4(fraction of bandwidth)=64 min bias/sec
- 200M min bias collected (4x previous)
  - 2B min bias for design Lumin-scale down ~20 (with duty factor)
- ~ 4800 omega to ee, 3000 phi to ee (exodus: 8900,1600)
  - Cent relative yield going to omega~phi
  - 0-5% 18%=860
  - 5-10 14%=670
  - 10-20 25%=1200
  - 20-30 13%=620
  - 30-40 10%=480
  - 40-100 20%=960

Do we need a trigger?
What can we do?

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What would we like? (from Tom's stuff)

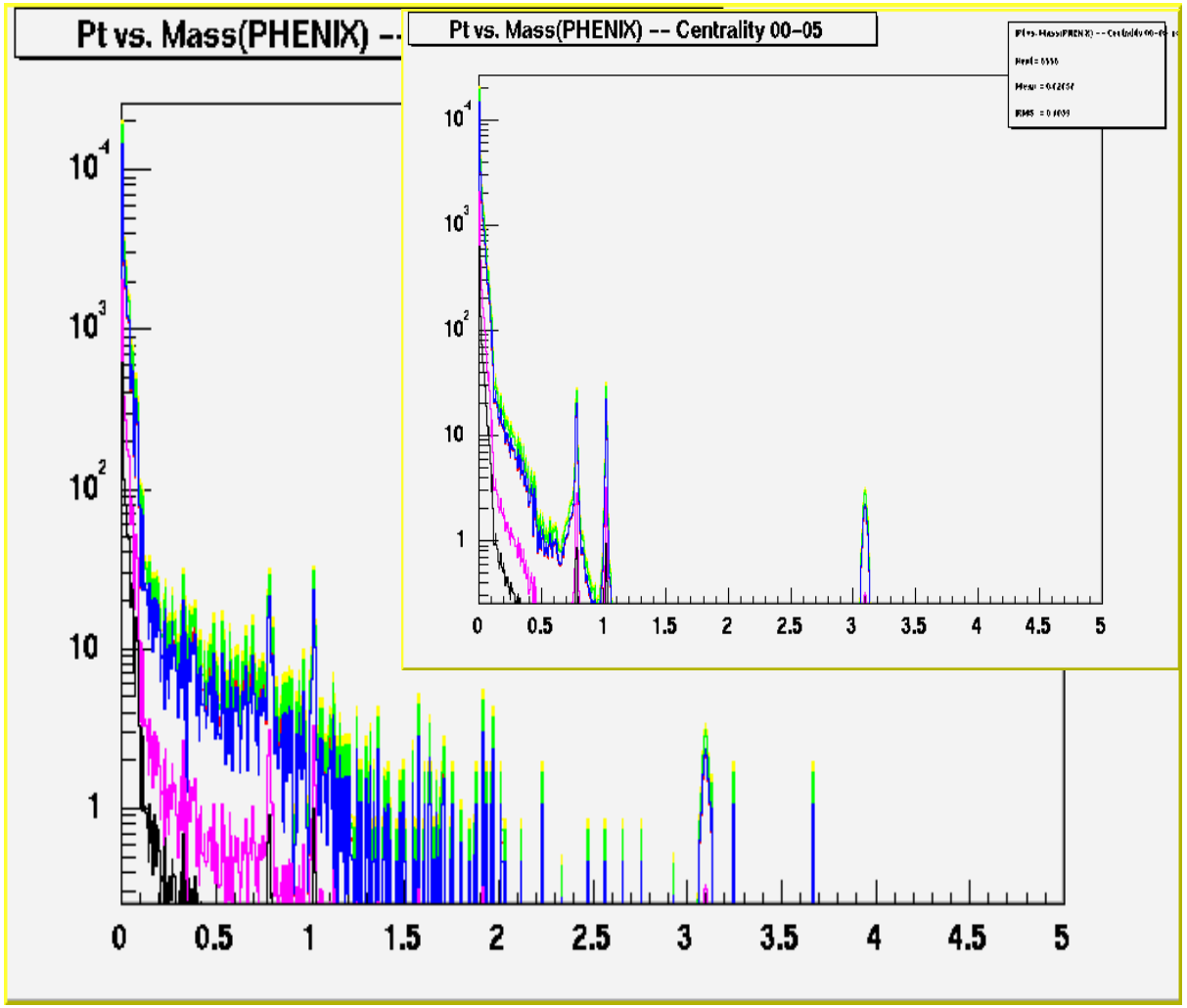
- Say we want ~5s in all centralities
- With min bias only ~20*4=80 signal, 4x100 bkgd

$$Significance = \frac{N_{sig}}{\sqrt{N_{sig} + N_{Background}}}$$

- S=80/sqrt(480)=3.6 (before it was 20/sqrt(120)=1.8
- We need an enrichment factor of 5, I.e. 400/sqrt(2400)=8 s
- I.e. look for a rejection factor in a trigger
- First check to see what the best we can do
  - Use Tom's plots assuming 60M instead of 200M
  - s~80

Signal pairs over all centralities

- Integrating the yield over all p_T, we see the following yields per bin in various centrality classes.
- Remember that PHENIX scales the widths of its centrality classes inversely to the multiplicity so



0-5% 5-15% 15-30% 30-60% 60-80% 80-92%

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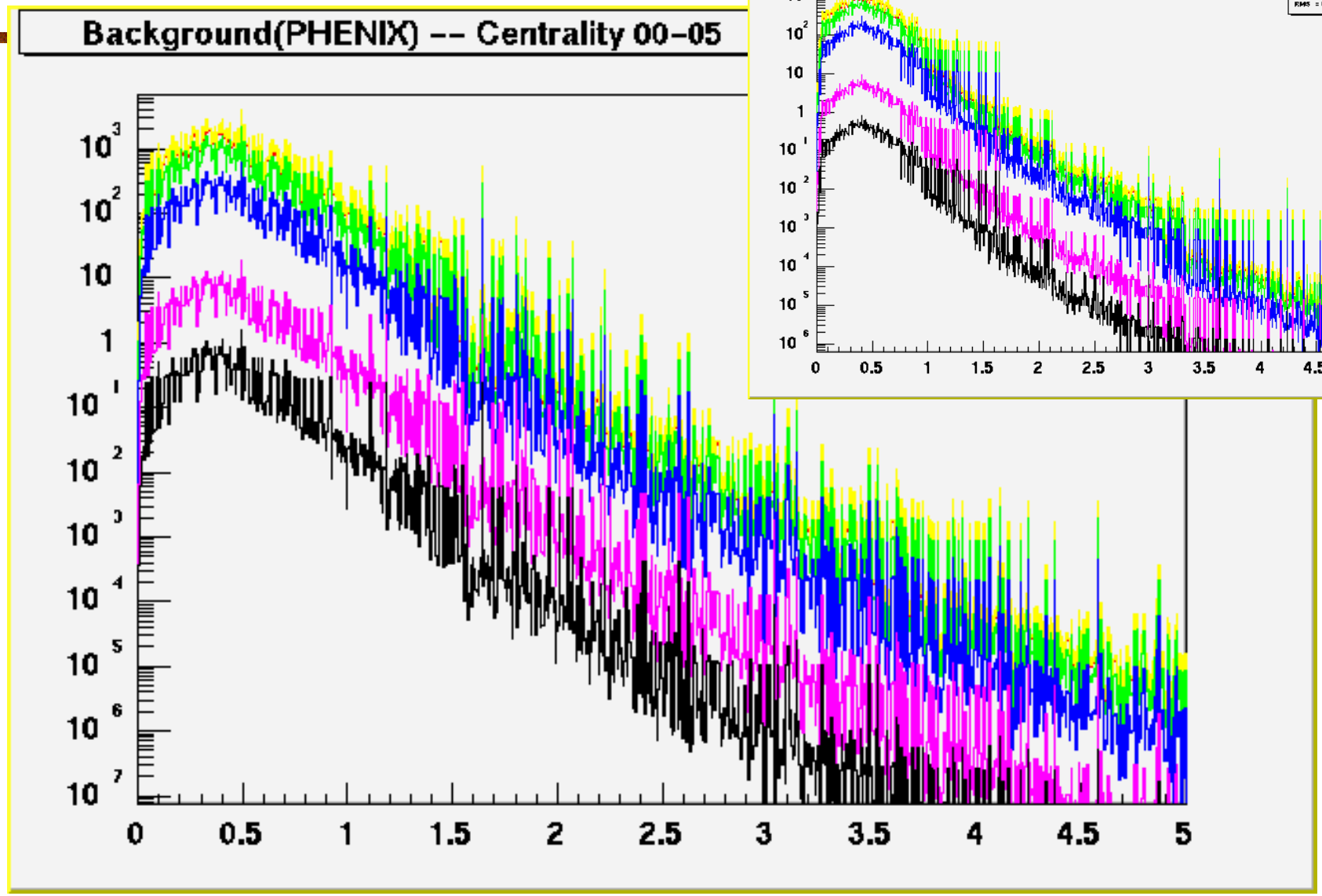
Background Pairs



0-5% 5-15% 15-30% 30-60% 60-80% 80-92%

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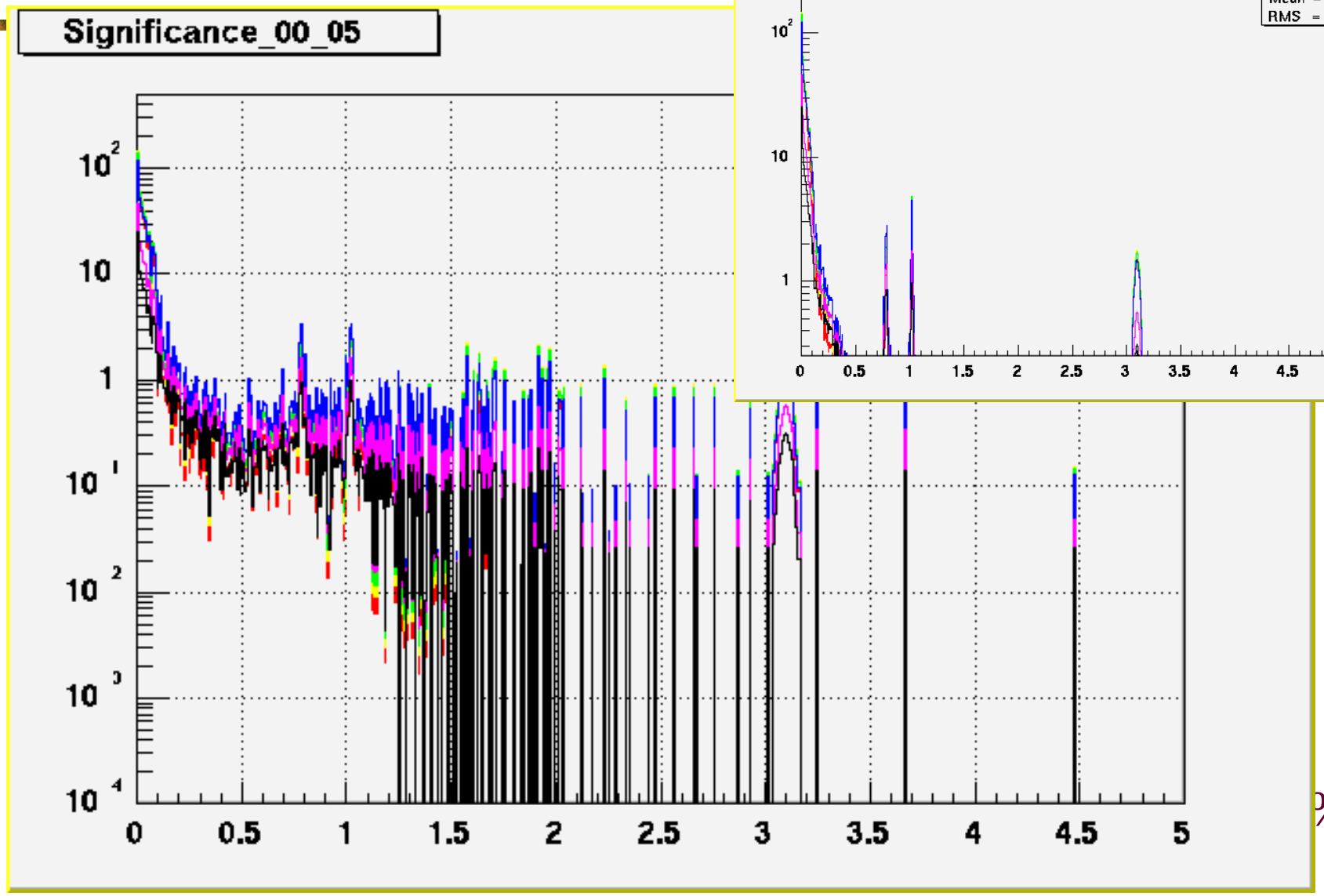
Statistical Significance



%

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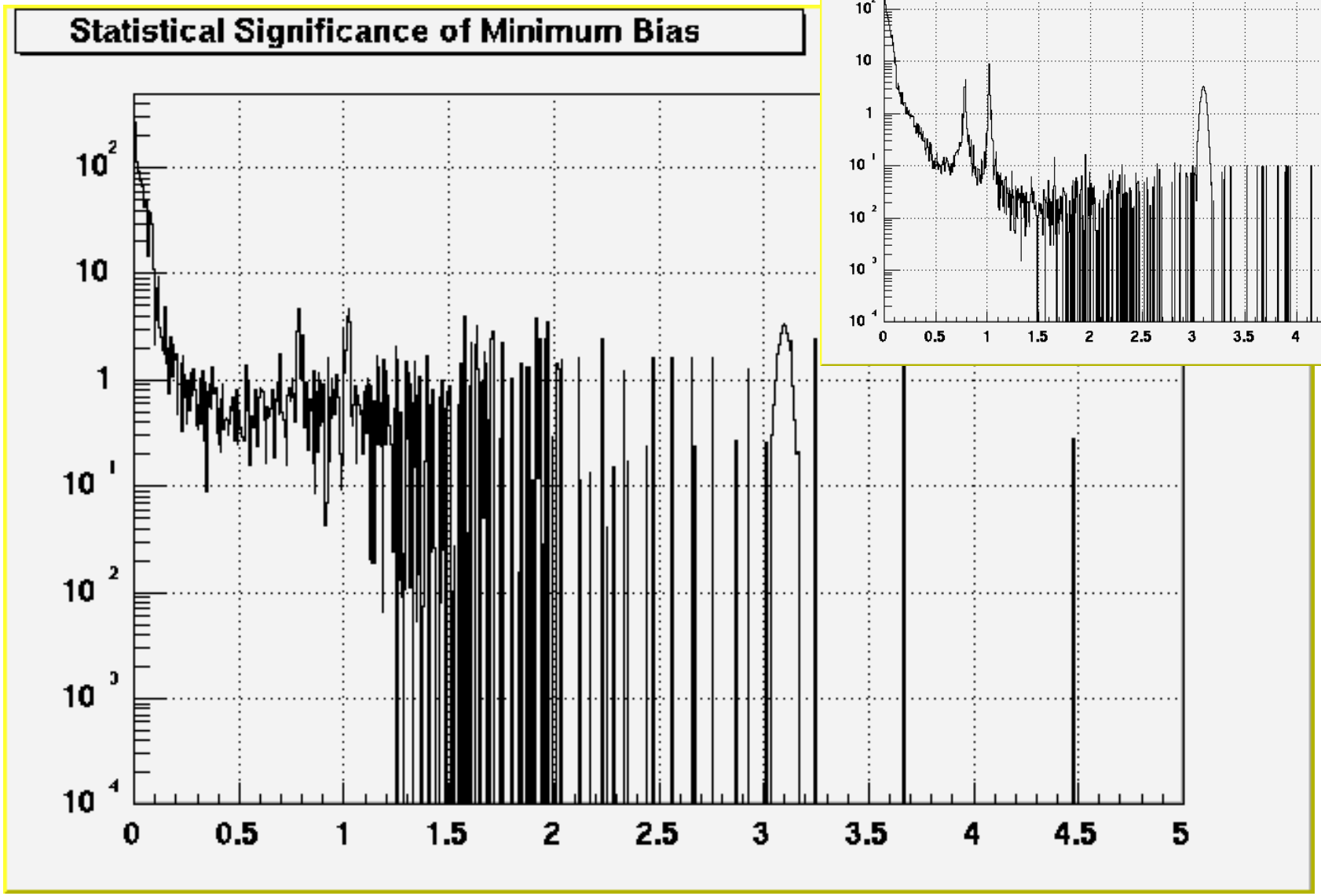
Statistical Significance Min Bias



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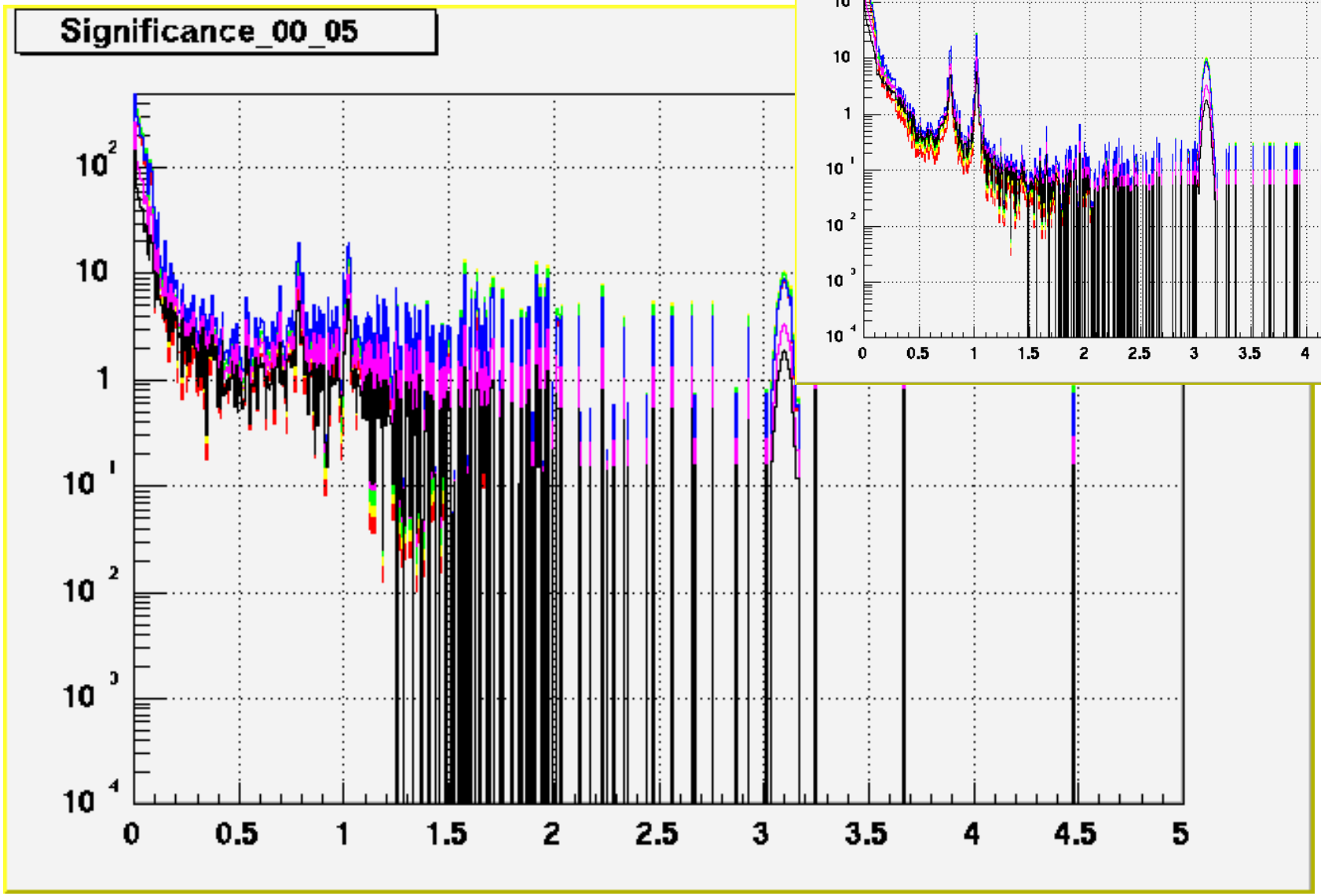
Statistical Significance Possible



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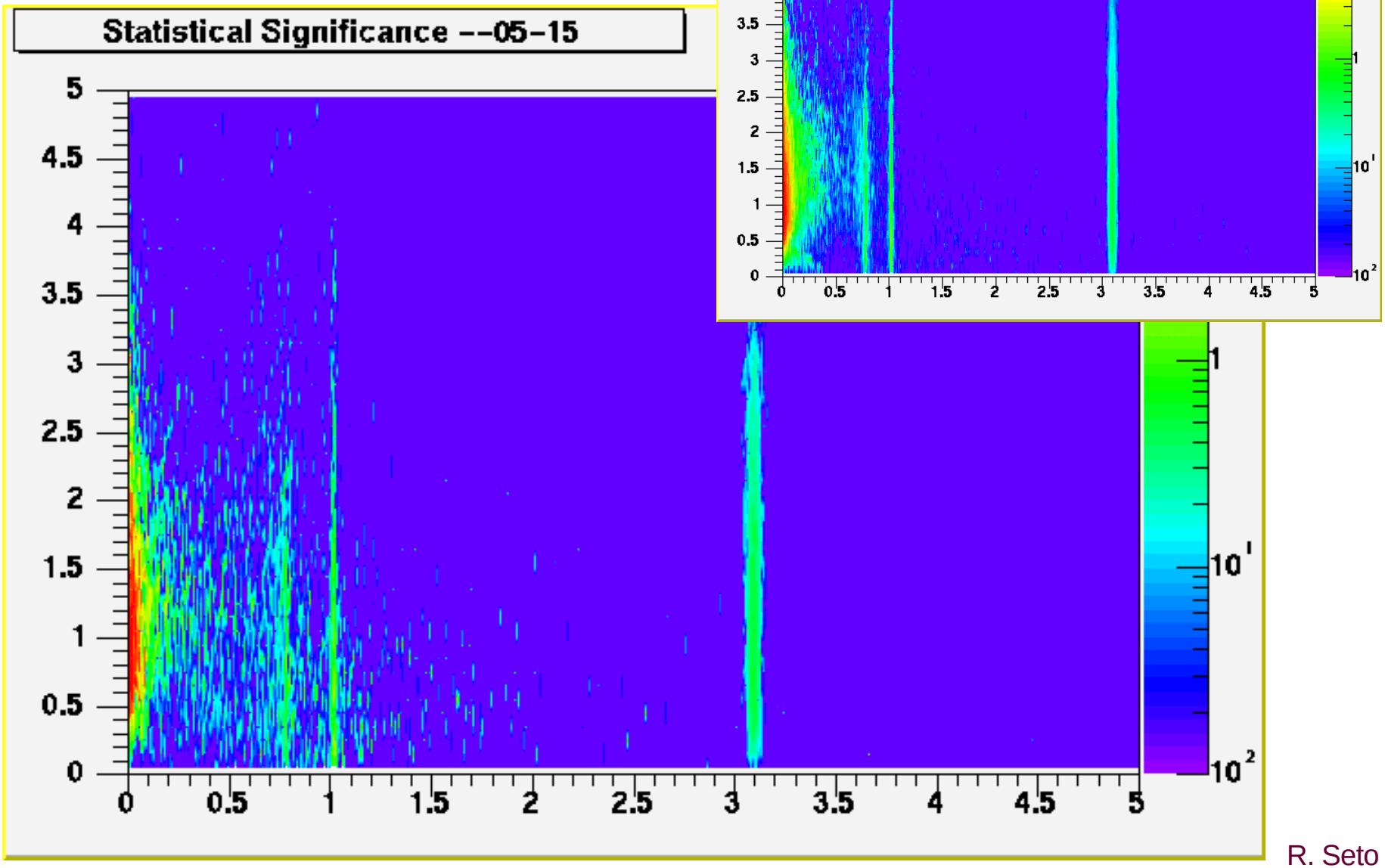
Statistical Significance --05-15
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
1
10
10 2

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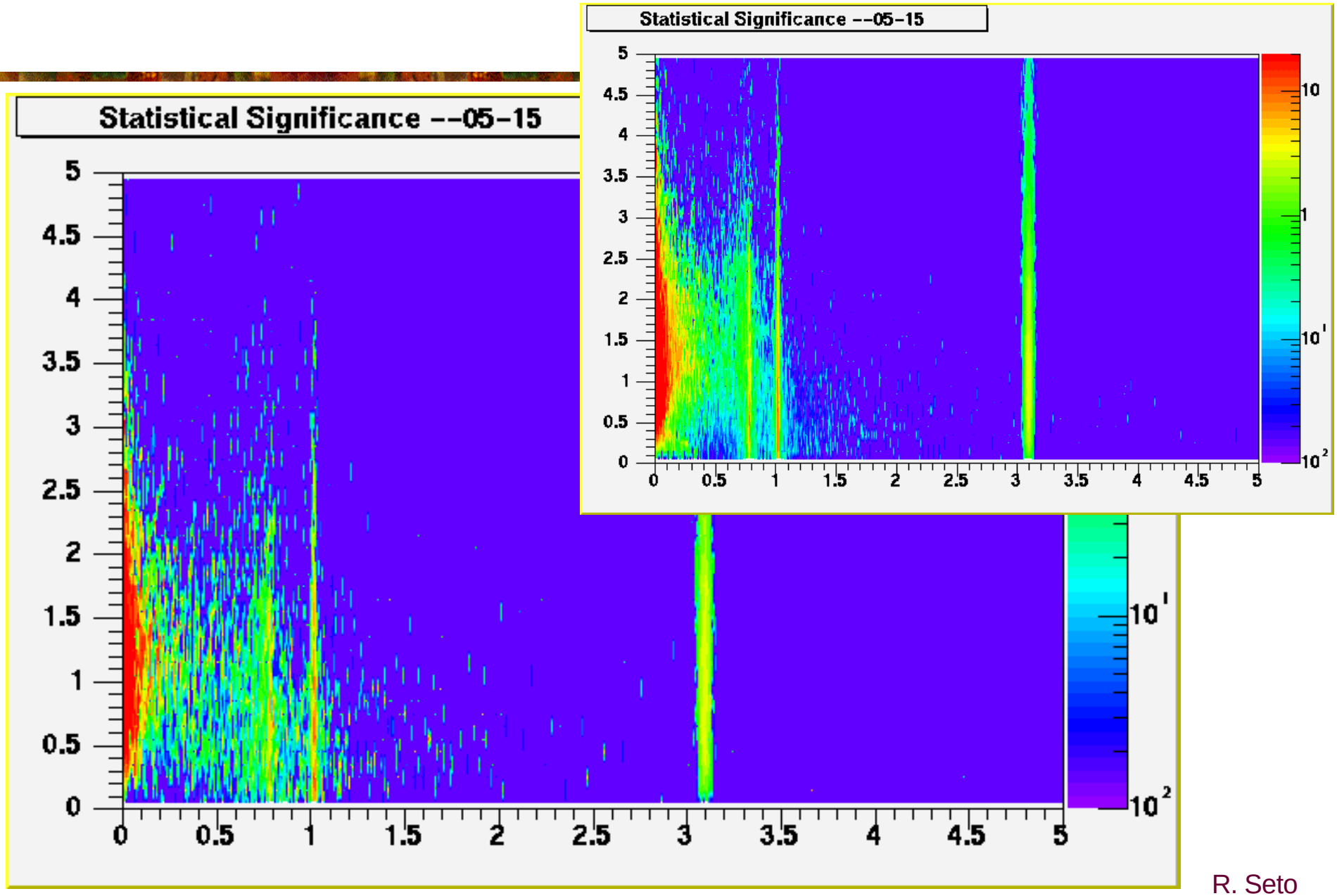
If we Collected All from RHIC



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Rejection factors for the phi,omega (wei)

- Phi
- emcal threshold of 380 MeV,
- m> 0.7 GeV
- Eff ~ 80%
- centrality RF prescale
- 0-5% 1 x
- 5-20% 1 x
- 20-30% 1.3 x
- 30-40% 2.3 (7%) 5
- 40-100% 45 (2%) 5

- Omega
- emcal threshold 380 MeV,
- m> 0.5 GeV,
- centrality RF
- 0-5%
- 5-20%
- 20-30%
- 30-40%
- 40-100%

- Note: we will get an additional factor ~2 from matching with pc3

- With this additional factor I hope we can find a combination which gives us a RF ~ 10 for centrality > 30%

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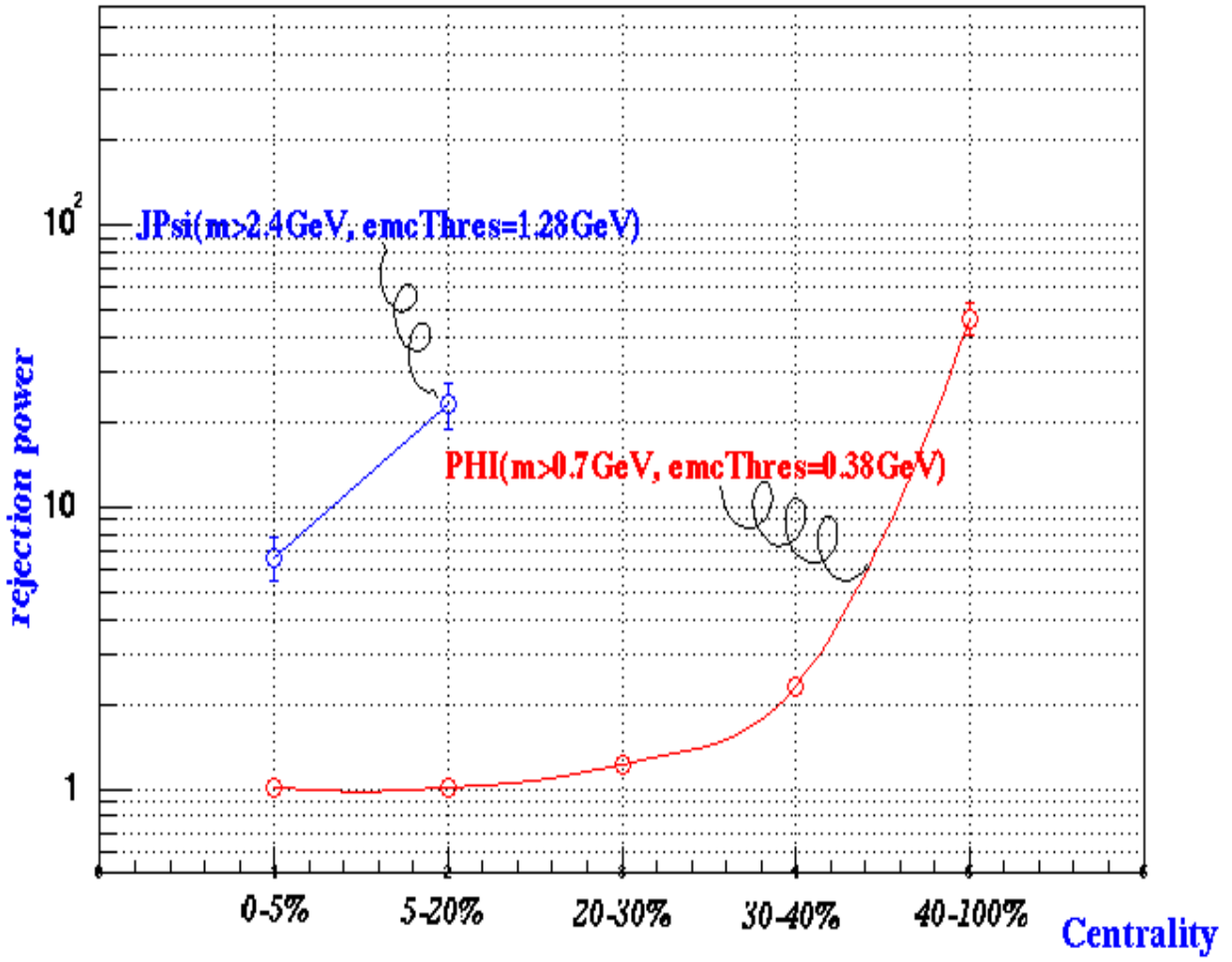
Rejections from Wei

- Still to try
  - PC3 cut using better emcal custering



Muon triggers as “min bias”

- Assume
  - <10% of Band width goes to this measurement
  - Min bias event 250 kB, central event 400 Kb, periph-100kB, 30-40%-200kB
- We will be able to use the muon triggers as a way to increase "min bias triggers". The argument goes as follows:
  - The rapidity difference between the muon arms and the central arm is large enough that stuff happening in one is largely independent of the other, save for dependence on centrality. Hence these triggers will be biased toward central events.
- use 10% BW – go after omega and phi
  - 2% of BW goes to 40-100% rf ~45
  - 7% of BW goes to 30-40% rf ~ 2.3
    - Note – eff for phi is ~80% (for omega – yet to do)

To get enrichment factors

- 40-100%
  - 40MB/sec*0.02(frac of Band width) /100kB/event*45(rf)/0.6(centrality)* = 600 events/sec
  - So we have enriched the 40-100% piece by a factor of 600/64=9 (we wanted 5)
- 30-40%
  - 40MB/sec*0.07(frac of Band width) /200kB/event*2.3(rf)/0.1(centrality)* = 322 events/sec
  - So we have enriched the 30-14% piece by a factor of 322/64=5
- 0-30%
  - We use the muon triggers here

A summary of deep-deep muon triggers (Jason)

%	rf	frac of events
0-5	6	.40
5-15	14	.30
15-30	30	.22
30-60	300	.04
60-100	300	.04
Total	50	
eff j/psi	.70	

Most of events come from 0-30% centrality!

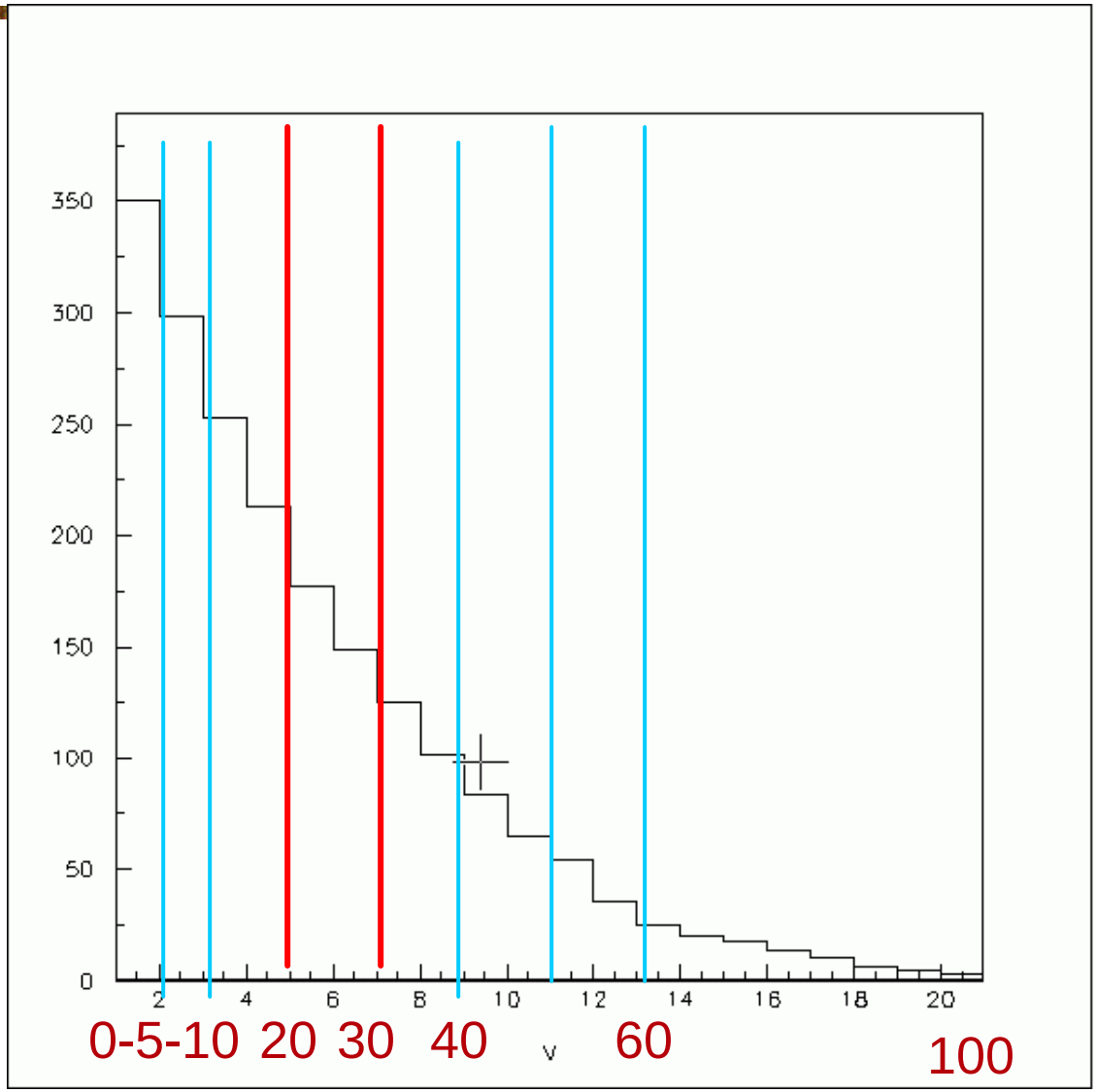
Enhancement factors

- To get enhancement factor
  - X0.75 (since 30% of BW instead of 40%)
  - X “fraction of events”
  - /centrality
  - But I can take less events because average event size is larger ~ 250/350 ~ .7
  - 0-5% enhancement factor = .75*0.4/.05 *.7 = 4.2
  - 5-15% =.75*.3/.15=1.5
  - 15-30% =.75*.22/.15=1.1
  - 30-60% =.75*.04/.3=0.1

A summary of muon triggers

%	b	dd-rf	frac	ds-rf	frac	ss-rf	1d-rf
0-5 (5)	1.6	5.5479	.9(.4)	2.9688	1.7(.34)	1.9257	2.2246
5-15 (10)	4.5	14.172	.7(.3)	5.2873	1.9(.38)	3.5986	3.1909
15-30 (15)	7.0	30.594	.5(.22)	11.692	1.2(.24)	8.3497	5.2873
30-60 (30)	10.	~300	.1(.04)	~300	0.1(.02)	300.47	76.297
60-100(40)	12.5	~300	.1(.04)	~300	0.1(.02)	300	66.046
Total		50		30?(20)		14	
eff j/psi		.70		.88		.88	

Nparticipant vs centrality



Conclusions/work

- I can trigger on peripherals
- Is triggering on the muons really OK?
  - Any homework?
- Summary: Want
  - Assume 40MB/second average with 50% duty factor for 10 weeks
  - 40% MB , 30% electron arms, 30% muon arms
  - Need 9% electron arm BW
    - 2% - 40-100%
    - 7% - 30-40%
- Total Enhancement factors (wanted 5)
  - 0-5% 5.2
  - 5-10% 2.5
  - 10-20% 2.1
  - 20-30% 1.1
  - 30-40% 6 (data hog)
  - 40-100% 10
- Note: enhancement factor of 2. will get me to 5s
  - If all my optimistic assumptions hold true